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ABSTRACT

This document describes the objectives and activities of a State-coordinated training program in curriculum evaluation. Seventy-five Maryland education supervisors and five from adjacent States were trained in identification, formulation, and evaluation of instructional objectives for science, mathematics, and humanities programs. Participants were taught to discriminate between well and poorly written objectives, to translate local program objectives into performance objectives, and to make decisions about curricular change. Appendixes provide lists of program participants and consultants, and sample copies of behavioral objectives developed by participants. (Author/LLR)

RESEARCH TRAINING CONFERENCE REPORT

Project No. 9-0218

Grant No. OEG-0-9-200218-2789

A TRAINING PROGRAM ON CURRICULAR EVALUATION FOR SELECTED MARYLAND EDUCATIONAL ADMINISTRATORS AND SUPERVISORS

James W. Latham, Jr.

Maryland State Department of Education

Baltimore, Maryland 21201

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U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
Bureau of Research

CONTENTS

SUMMARY

In this program, some 75 Maryland education supervisors, plus 5 from adjacent states, were trained in identifying, writing, and evaluating instructional objectives for programs of science, mathematics, and the humanities. They were taught how to discriminate between well written and poorly written objectives, and were enabled to translate local program objectives into performance objectives. They were provided with a basis for making decisions about curricular change.

The training was given in a one-week conference at the Center for Adult Education on the University of Maryland campus, and at a three-day conference at the Tidewater Inn in eastern Maryland. During the first week, each participant completed an individualized assessment sequence, and participated in three evening seminars designed to supply them with collections of ideas on evaluations related to models, implementations, and methodology. During the three-day follow-up conference offered several months later, the focus was on curriculum information in the three subject areas, and the writing of behavioral objectives to be used in their own school districts. Hierarchies were developed for the learning sequences, which will be evaluated from the practical situations.

INTRODUCTION

Problem

Since 1959, most of the course content improvement projects which have been developed by private and public monies have been introduced in varying degrees into the science and mathematics classes of the Maryland Public Schools. During this same time period, our larger local educational units have been actively involved in revising and developing local curriculum guides for these subjects. Many of our smaller local educational units have asked the State Department of Education to develop and provide curriculum guides.

With all this activity in selecting, developing and implementing new curricular programs in science and mathematics, there is much reason for concern. At the state or local level, we have not established criteria for program selection or development based on any set of course objectives. Furthermore, we have not identified objectives for programs which permit the measure of student achievement of the stated objectives. In the absence of such criteria, programs are currently selected or developed by local groups of science and mathematics supervisors and teachers on the basis of their personal feelings about the course. Student achievement of program objectives is so vague that it receives a variety of interpretations when translated by teachers. Thus evaluation of pupil achievement for any stated objective is a measure of how well the student performs what the teacher thinks the objective calls for.

Obviously, therefore, there was a need to identify more clearly program objectives in science and mathematics and to state these objectives in a precise language which will permit more accurately measurement of stated objectives.

All of the science and mathematics supervisors have entered supervision with backgrounds in classroom teaching in the subject area. In the smaller educational units, they are general supervisors with responsibilities which also include science and mathematics. Many of our local college and university consultants who assist in the development of curriculum guides are basically trained only in their subject area. Therefore, most of the Maryland educational leaders in science and mathematics lack the specialized training in research and evaluation necessary for identifying program objectives and for stating them in a precise language which permits the measurement of student performance. There is also a need to initiate this crucial training for persons responsible for curricular programs in the humanities.

Objectives

This program was planned to train a group of approximately seventy-five Maryland educational supervisors to identify, write and evaluate objectives for instructional programs in science, mathematics, and the humanities.

At the end of the program, the participants were able to demonstrate their ability to perform the following tasks:

1. Identify evaluative techniques which can be utilized to provide information for making decisions about curriculum change

2. Identify the objectives for a specific program in science, mathematics, or the humanities

3. Discriminate between well-written and poorly-written objectives

4. Identify and construct performance objectives

5. Translate (where possible) into performance objectives the objectives of a science, mathematics, or humanities program which are stated in non-behavioral terms

6. Order performance objectives into a hierarchy.

DESCRIPTION OF THE ACTIVITIES

The activities of the project were conducted in three phases.

Phase 1

A one-day planning and coordinating conference was conducted in January 1969. Participants included: the project director, the project instructors and the subject area coordinators. Responsibilities for each project staff member were assigned, the daily schedule for phase two was revised and adopted, and plans for evaluating and reporting the conference findings were finalized.

Phase 2

A five-day conference was conducted from March 10-14, 1969, at the Center for Adult Education, University of Maryland Campus. Participants includedeighty educational administrators and supervisors who had specific curricular responsibilities for science, mathematics and the humanities. Seventy-five participants were selected from the State of Maryland and five from adjacent states. The Maryland participants included representatives from the State Department of Education, the local educational agencies, and the state colleges and universities.

Procedures

Each participant individually proceeded through a sequence of specific behaviors which composed the instructional program. Three University of Maryland instructors provided background information in large group presentations. Small groups were organized in the areas of the humanities, science and mathematics. State Department of Education

coordinators and staff members assisted the university instructors in providing the participants with the necessary instruction and assistance within these small groups. Time was provided for each participant to work independently on the assessment sequence. Consultant help from the project staff was made available to the individual participants. Evening seminars were designed and conducted to present the total group with a wide variety of current ideas on evaluation from the standpoint of models, implementation, and methodology. Outstanding consultants were used to conduct these seminars.

Monday

9:00-10:00 a.m.	Registration
10:00-11:00 a.m.	First General Session
11:00-12:00 noon	Work Groups (Tasks 1-2)
12:00- 1:30 p.m.	Lunch
1:30- 4:30 p.m.	Work Groups (Tasks 3-8)

Tuesday

9:00-10:00 a.m.	Second General Session Hypotheses of Learning Dependency
10:00-12:00 noon	Work Groups (Tasks 9-16)
12:00- 1:30 p.m.	Lunch
1:30- 2:00 p.m.	Third General Session - Assessment Tasks
2:00- 4:30 p.m.	Work Groups Tasks (17-19)
6:30- 7:30 p.m.	Banquet
7:30- 9:00 p.m.	Seminar - Evaluation in the Humanities

Wednesday

9:00-12:00 noon	Work Groups (Tasks 20-24)
12:00- 1:30 p.m.	Lunch
1:30- 2:00 p.m.	Fourth General Session - Analysis of Data
2:00- 4:30 p.m.	Work Groups (Tasks 25-30)
6:30- 7:30 p.m.	Banquet
7:30- 9:00 p.m.	Seminar - Evaluation Methodology

Thursday

9:00-12:00 noon	Work Groups (Tasks 31-34)
12:00- 1:30 p.m.	Lunch
1:30- 4:30 p.m.	Work Groups (Tasks 35-37)
6:30- 7:30 p.m.	Banquet
7:30- 9:00 p.m.	Seminar - Evaluation in the Sciences

Friday

9:00-12:00 noon	Work Groups
12:00- 1:30 p.m.	Lunch
1:30-2:15 p.m.	Work Groups
2:15- 3:00 p.m.	Fifth General Session
3:00 p.m.	Adjourn

The Learning Sequence

The proposed learning sequence consisted of forty-six specified behaviors. The learner was expected to proceed through the sequences starting with the behavior labelled # 1. Each behavior was associated with an individualized task and an individually administered assessment of the behavior. The proposed learning sequence included the acquisition of behaviors related to the construction of behavioral objectives; the design of assessment tasks; the instruction of learning sequences and their empirical foundations. Supporting instructional materials included: Constructing Behavioral Objectives by Walbesser, Taxonomy of Educational Objectives, Cognitive Domain, edited by Bloom and the Affective Domain, edited by Krathowald; The Conditions of Learning by Gagne; and the American Educational Research Association's, Monograph Series # 1 on evaluation; the Popham Film Strip series on Objectives and Evaluation Model and Its Application by Walbesser; Preparing Instructional Objectives by Mager; Science Teaching and Testing by Nedelsky, and finally Developing Attitudes Toward Learning by Mager.

The following tasks comprised the learning sequence:

1. Identify descriptions of observable performance
2. Construct definitions for classes of performance which can be exhibited in a variety of settings (e.g. picking up, building)
3. Construct tasks illustrative of a class of performances
4. State a definition of a behavioral objective as a description of performance which includes six components:
   (1) who performs
   (2) what performance class
   (3) what is acted upon
   (4) what initiates action
   (5) what constitutes an acceptable response
   (6) what restrictions are there on an acceptable response
5. Identify each of the six components in a behavioral objective, given Walbesser's definition of a behavioral objective and a statement of a behavioral objective
6. Describe the meaning of each of the six components in Walbesser's definition of a behavioral objective
7. Distinguish between the statement of a behavioral objective and a non-behavioral objective
8. Describe the procedures used to obtain a set of action verbs
9. Describe why the definition of a set of action verbs is useful in the construction of behavioral objectives
10. Demonstrate the use of a set of action verbs in the completion of statements describing various human performances
11. Demonstrate the procedures used in the construction of a set of action verbs and construct definitions for each of the verbs selected, given a set of instructional activities for which behavioral objectives are to be constructed.
12. Identify the subordinate behaviors, given an hypothesis of learning dependency
13. Identify the terminal behavior, given an hypothesis of learning dependency

14. Construct individualized instructional activities in performance agreement with any of the action verbs
15. Name the subordinate behaviors, given a hypothesis of learning dependency
16. Name the terminal behavior, given an hypothesis of learning dependency
17. Identify behavioral objectives in performance agreement with a given task
18. Identify tasks in performance agreement with a given behavioral objective
19. Identify instructional activities in performance agreement with a behavioral objective
20. Identify behavioral objectives in performance agreement with an instructional activity
21. Distinguish between a learning hierarchy and an hypothesis of learning dependency
22. Identify the hypothesis of learning dependency, given a particular terminal behavior and a learning hierarchy with more than one hypothesis
23. Construct an assessment task for a given behavioral objective
24. Construct behavioral objectives for an instructional activity
25. Name the hypothesis of learning dependency, given a particular terminal behavior and a learning hierarchy
26. Construct the statement of a behavioral objective and an assessment task given the statement of a non-behavioral objective
27. Construct behavioral objectives and an assessment task for a behavioral objective
28. Construct an instructional activity and assessment task for a behavioral objective
29. Construct an hypothesis of learning dependency, given a description of the terminal behavior
30. Identify the hypothesis being tested with the adequacy ratio, given the terminal behavior and the subordinate behaviors
31. Identify the hypothesis being tested with the consistency ratio, given the terminal behavior and the subordinate behaviors
32. Demonstrate how to find the completeness ratio, given performance data and the hypothesis of learning dependency
33. Demonstrate how to find the adequacy ratio, given performance data and the hypothesis of learning dependency
34. Demonstrate how to find the consistency ratio, given performance data and the hypothesis of learning dependency
35. Identify data which indicate reversals on a learning hierarchy, missing subordinate behaviors, inadequate item construction, ineffective instructional activities
36. Describe the procedures for validating a learning hierarchy
37. Construct revisions in a learning hierarchy based upon decisions arrived at from performance data on the various hypotheses of learning dependency
38. Demonstrate how to validate one hypothesis of learning dependency, given an hypothesis with one subordinate behavior (repeat for two and three subordinate behaviors)
39. Demonstrate the collection of data for testing a learning hypothesis in a learning hierarchy

40. Describe the results of the tests of hypothesis for a learning hierarchy based upon collected data
41. Construct a learning hierarchy, given the statement of the terminal behavior for the hierarchy
42. Construct the assessment tasks to accompany each cell of the learning hierarchy constructed by the student
43. Construct instructional activities to accompany each cell of a learning hierarchy constructed by the student
44. Demonstrate procedures for carrying out the validation of a learning hierarchy constructed by the student
45. Demonstrate the reporting of the validation of the student's hierarchy in the form of a research report acceptable for publication by a research journal and with sufficient detail to make possible the replication of the investigation
46. Construct revision of the learning hierarchy constructed by the student based upon the performance data collected.

Phase 3

One three-day follow-up session, June 2, 3, and 4, 1969, was held at the Tidewater Inn, Easton, Maryland. Since all of the original 80 participants had become so actively involved they were all invited back for the concluding session. All but two of the participants accepted the invitation to return.

The expected product of Phase 3 was to develop a model from curriculum representing each of the disciplines for grades K-12 from each of the counties represented. These models in turn are to be distributed throughout the State to key curriculum workers.

Personnel and Facilities

Maryland State Department of Education

Three State educational supervisors coordinated the program for the three areas--Science, Mathematics, and the Humanities. They assisted the instructors in the learning series by serving as assessment consultants. They selected the participants for their respective subject areas and assisted in the project evaluation and preparation of the final report. Each one spent 20-30 percent of his time with the project.

The three supervisors include:

James W. Latham, Jr.,	State Supervisor of Science, Project Director and Coordinator of the Science area
Thomas E. Rowan,	State Supervisor of Mathematics Project Coordinator of the Mathematics area
James L. Fisher,	State Supervisor of Music Project Coordinator of the Humanities area

University of Maryland

Three professors from the University of Maryland provided the instruction for the institutes. They secured the appropriate consultants for the seminars, arranged for the use of appropriate university facilities, conducted project evaluation, and provided assistance in the preparation of the final report. Each one spent fifteen days with the project.

The three professors include:

Dr. J. David Lockard,	Director of the University of Maryland Science Teaching Center Director of the International Clearinghouse for Science and Mathematics Developments Associate Professor Botany and Science Education
Dr. Henry H. Walbesser	Director of the Evaluation Program of AAAS - Science a Process Approach Director, University of Maryland Mathematics Project Associate Professor of Mathematics Education
Dr. James Raths,	Director of the University of Maryland Bureau of Educational Research and Field Services Professor of Education

Consultants

Consultants provided the group with collections of ideas associated with evaluation from the standpoint of models, implementation, and methodology. They also presented information on current leading research in the three disciplines - Science, Mathematics, and the Humanities. The consultants who conducted these seminars included individuals such as Ed Kurtz, Kansas State Teachers College; Bertram Masia, Case Western Reserve University; Leonard Cahen, Educational Testing Service; and Paul Lehman, University of Kentucky.

EVALUATION

The evaluation report is separated into two sections. The first one considers evaluation information relative to the first five-day institute held at College Park, Maryland. The second session reports evaluation information on the three-day follow-up conference held at Easton, Maryland.

Section One - Initial Training Conference

It was planned that the participants would complete thirty-seven tasks. The conference leaders had decided upon a goal of 90/90 acquisition. That is 90 percent of the participants were expected to acquire 90 percent of the behaviors represented by the thirty-seven tasks. This was an ambitious goal.

The time schedule proved to be inappropriate. Most participants needed and used evening hours as well as the daytime hours to work on the desired tasks. It was common to find a dozen or more participants still working at midnight. The 90/90 level of acquisition was attained by the conference participants.

Participant interest and sustained enthusiasm was high throughout the conference. Willingness to work long hours is primary evidence for this contention. The change of pace provided by the dinner speakers made a significant contribution to maintaining the spirit and eagerness of the conference participants. Some competition developed among the various teams of participants working on the tasks. This also helped to maintain interest. Finally it should be observed in the evaluation statement about the institute that no one quit the conference.

Section Two: Follow-up of the First Conference

The construction of a learning hierarchy and the accompanying instructional and assessment support for it provided the organizational framework for the follow-up conference. For this second institute the working teams were organized around special interests. The expectation for the follow-up conference was that each team: (1) produce a learning hierarchy or hierarchies that would cover a long instructional time period (an entire semester or school year), (2) construct accompanying instructional activities and assessment tasks for the hierarchies developed, and (3) design a plan for validating the developed hierarchies during the school year. These expectations proved to be too ambitious. At least one such hierarchy was roughed out by all but one of the working teams. About one-half of the teams managed to construct assessment tasks. All of the teams settled on some implementation plan.

In the most meaningful sense, it is too early to evaluate the success or failure of the institute and follow-up institute. If the institute participants construct and try out hierarchies in their own school systems

around the State of Maryland, then the institute will have succeeded well beyond the mere acquisition of the behaviors represented by mastery of the tasks. Some evidence now exists to suggest that this is the case. Baltimore, Howard, Montgomery, Caroline, Kent, Queen Anne's, and Talbot Counties all have learning hierarchy projects. Most have them in more than one subject area and many at more than one educational level. The potential created by making a direct impact on the school systems of an entire state certainly argues for the worth of the institute.

APPENDICES

A. PARTICIPANTS INVITED TO MARYLAND STATE DEPARTMENT OF EDUCATION TRAINING PROGRAM ON CURRICULAR EVALUATION

SCIENCE

Bloom, Harold - Anne Arundel Supervisor of Science
Burke, Edmund - Montgomery County Supervisor of Science
Conway, Charlotte - Supervisor of Home Economics - MSDE
Crawford, George - Supervisor of Curriculum - MSDE
Davis, Charles - State Department of Education, Richmond, Virginia
Dennison, Louise - Caroline County Supervisor of Elementary Education
Frank, Paul - Garrett County Supervisor of Science
Hale, Helen - Baltimore County Science Coordinator
Heck, John - Baltimore County Supervisor of Science
Herman, Sam - Baltimore County Supervisior of Science
Hodgdon, Kendrick - Allegany County Supervisor of Science
Jones, William T. R. - Baltimore County Supervisor of Elementary Education
Love, Robert - Prince George's Community College
Maas, Neil - Broome Junior High School - Montgomery County
Manspeaker, John - Charles County Supervisor of Science
McMahon, Alma - Baltimore City Curriculum Specialist
McNeish, Robert - Science Department Chairman - Baltimore County
Moorefield, William - Science Education - Towson State College
Myers, Alan - Supervisor of Industrial Arts - MSDE
Oursler, Joseph - Science Department Chairman - Baltimore County
Palmer, Elra - Baltimore City Supervisor of Science
Pancella, John - Montgomery County Supervisor of Science
Parker, Carroll - Science Department Chairman - Baltimore County
Pettigrew, Everett - Anne Arundel Supervisor of Elementary Education
Pumphrey, Frank - Regional Coordinating Supervisor - MSDE
Rosen, Richard - University of Maryland Science Teaching Center
Schweitzer, James - Gaithersburg High School - Montgomery County
Spencer, Marvin - Frederick County Supervisor of Science
Wickless, Janice - Regional Coordinating Supervisor - MSDE

MATHEMATICS

Arbogast, Dale - Elementary Principal - Charles County
Binder, William - Winand Elementary School - Baltimore County
Brant, Vincent - Coordinator of Mathematics - Baltimore County
Bullard, Elizabeth H. - Calvert County Supervisor of Elementary Education
Clark, William - Supervisor of Mathematics - Montgomery County
Ghormley, Robert - Kent County Supervisor of Elementary Education
Johnson, Duane - Dumbarton Junior High School - Baltimore County
Mason, Andrew - Regional Coordinating Supervisor - MSDE
Mauro, Carl - Anne Arundel Supervisor of Elementary Education
Mills, Joseph - Stemmers Run Junior High School - Baltimore County
Moore, Howard - Teacher Specialist - Talbot County
Nossick, John - Elementary Principal - Dorchester County

Sangston, Beverly - Computer Specialist - Montgomery County
Thomas, Robert T. - Allegany County Assistant Supervisor of Mathematics
Thompson, Brent A. - St. Mary's County Helping Teacher - Mathematics
Turner, Francis - Holabird Junior High School - Baltimore County
Warneking, Glenn - Cecil County Supervisor of Science and Mathematics
Watkins, Louise - Howard County Supervisor of Mathematics and Science
Woodburn, Douglas- Perry Hall Junior High School - Baltimore County
Zimmerman, Carl L. - Mathematics Department - Towson State College

HUMANITIES

Addy, James - Supervisor of Social Studies - MSDE
Armstrong, Charles - Charles County Supervisor of Music
Browne, Annilea - Washington County Supervisor of Elementary Education
Corddry, George - Wicomico County Supervisor of Instruction
DeBalso, Raymond - Montgomery County Public Schools
Devers, Diana - Montgomery County Public Schools
Derby, Catherine - Montgomery County Public Schools
Gardner, William - Fine Arts Consultant - Cooperative Curriculum Services Center
Gunther, Robert - Supervisor of Instructional Television - MSDE
Hahn, LaVern - Allegany County Supervisor of Music
Hammond, W. Dorsey - Supervisor of Reading - MSDE
Hoff, Mary-Elizabeth - St. Mary's County Supervisor of Special Programs
Hrebenach, Emil - Montgomery County Supervisor of Art
Hutcheson, Thomas - Harford County Supervisor of High Schools
Klier, Katherine - Baltimore County Consultant Curriculum and Publications
Kotulak, Victor - Supervisor of English - MSDE
Lembach, John - Department of Art Education - University of Maryland
Lott, Harold - Supervisor of Art - MSDE
Miller, Eugene - Howard County Supervisor of Art and Music
Morgan, James - Montgomery County Public Schools
Oehlker, Bill - University of Delaware
Palazzo, Carmelo - Cecil County Middle School Assistant Principal
Poore, Thomas - Montgomery County Public Schools
Roach, James - Montgomery County Public Schools
Roberts, Clyde - Washington County Coordinator of Art
Rodgers, Lilliam - Carroll County Supervisor of English and Foreign Languages
Rogers, Lois - Anne Arundel Supervisor of Music
Richardson, Ann - Charles County Assistant in Art and Foreign Languages
Richardson, Harry - Prince George's County Helping Teacher - Art
Shelly, Shirley - Department of Music Education - University of Maryland
Smith, Gary - Frederick County Music Department Chairman
Sowers, Mildred - Director of Curriculum - MDSE
Striby, James - Supervisor of Student Teacher Education - Maryland Institute
Usilton, Fred - Caroline County Director of Instruction
Wenner, Gene - Fine Arts Education Advisor - Pennsylvania State Department of Education
Woodward, Louella - Supervisor of Curriculum - MSDE
Zack, Carolyn - Montgomery County Public Schools
Zenge, Sara - Washington County Coordinator of English

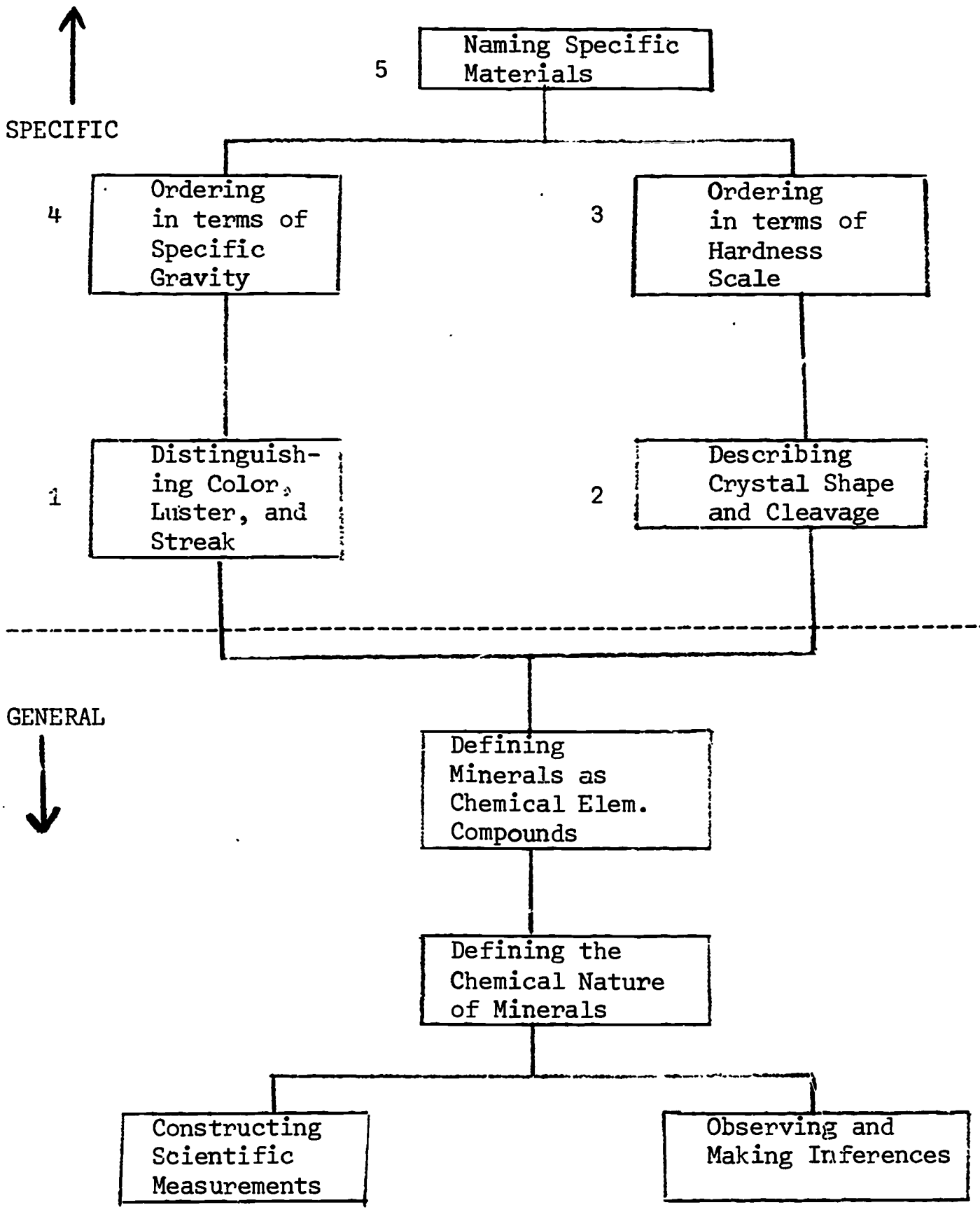
B. CONSULTANTS

James L. Fisher
William L. Gray
Mary Harbeck
Ed Kurtz
James W. Latham, Jr.
J. David Lockard
Bertram Masia
James Raths
Henry H. Walbesser

SCIENCE

Sample of a Content Hierarchy Related to
Activities 5, 6, 7, 13, 14, 15

The following is a hierarchy of skills or concepts in an areas of Geology. Those which appear below the dotted line are assumed to have been previously acquired by the students. Those which appear above the dotted line will be stated and developed in this paper in terms of performance or behavioral objectives. Instructional methods and assessment tasks will follow each stated objective.



Objective One

Given mineral samples such as quartz, calcite, galena, pyrite, talc, feldspar, mica, apatite, sulfur and graphite, the seventh grade student will be able to distinguish among color, luster, (glassy, metallic, waxy or dull) and streak color (color of mineral powder) during a class period as initiated by the teacher.

Instructional Method - Inductive, Discovery

The students will work in small groups of three or four. Each group will be provided with four or five of the minerals listed in the objective such that all characteristics in the objective will be represented. A porcelain tile will be provided on which the minerals can be rubbed to examine the color of the powder.

Students will be asked to observe only the general appearance of the minerals and the color of the streak they make on the streak tile. The students will list the various characteristics they observed.

The teacher will reserve fifteen minutes at the end of the session to list the various group observations on the chalkboard. The teacher will help the students in classifying their observations under the headings of color, luster, (how minerals reflect light) and the color of the mineral streak. No emphasis will be placed upon the identification of the mineral names. Use reference reading in Exploring Earth Science, Thurber and Kilburn, p. 212.

Assessment Task

Each student will be provided with three representative minerals for color, luster and streak and a streak plate. If materials are not plentiful, students can be grouped as three or four around the samples. No talking should be permitted. A number or letter will be attached to each sample. Students will observe each mineral and they will distinguish among those samples which exhibit the characteristics in the following chart:

Sample Letter	Color	Luster	Streak

Correct responses:

Quartz	clear white or pink	glassy	none
Graphite	black	metallic	black
Feldspar	red, pink	waxy	white
Talc	white, gray	waxy	white
Galena	black, gray	metallic	black
Pyrite	bronze, golden	metallic	greenish-black

Objective Two

Given the following crystalline minerals: Quartz, calcite, halite, galona, pyrite and feldspar, the seventh grade student will be able to describe various crystalline shapes or cleavage planes during one class period. These shapes are hexagonal, rhomboidal, euboidal and rectangular solid. The teacher will initiate the activity.

Instructional Method - Inductive

The teacher will distribute a variety of out-outs of solid geometrical figures which will include those outlined in the above objective. There will also be a variety of figure dimensions included. Appropriate cut and paste materials will also be provided. After students have cut and pasted the figures, the students will be asked to try to name the solid figures or to describe them on the basis of the shape of the plane faces of each solid.

The teacher will reserve fifteen minutes at the end of the class period to discuss the way in which the collection of solids should be grouped. The solids will be grouped on the basis of their names on a table somewhere in the classroom.

Assessment Task

Each student (or group of students if necessary) will receive two or three minerals which exhibit good crystal structure or cleavage. The students will observe the minerals and they will describe the crystal shapes of each numbered sample.

Appropriate responses would be:

1. (quartz) - hexagonal
2. (calcite) - rhomboidal
3. (pyrite) - cuboidal
4. (halite) - cuboidal
5. (galena) - cuboidal
6. (feldspar) - rectangular or right angle cleavage (break)

Objective Three

Given a copper penny, a piece of steel (knife blade) and a square of glass, plus the fingernail of the student, the seventh grade student will be able to order the hardness of five different minerals according to a hardness scale of one to ten, softest to hardest. This will be accomplished during one class period and the activity will be initiated by the teacher.

Instructional Method - Self Instruction

The student will read page 213 in Exploring Earth Science by Thurber and Kilburn.

Complete the following questions:

1. The hardness of a mineral refers to how it _____.

   A. breaks by another mineral or object B. streaks C. scratches or becomes scratched D. shows metallic luster

2. The hardness scale for minerals had a range of 1 - 10 arranged from _____.

   A. softest to hardest B. light streak to heavy streak
   C. glass to fingernail D. hardest to softest

3. The hardness of a mineral refers to its ability to scratch _____.
   A. other objects of standard hardness B. glass only
   C. a diamond D. other minerals only

4. The best way to tell whether a scratch was made on a mineral is to _____.

   A. look at the change in color B. rub on the mineral to see if a scratch is really on it C. rub on the mineral to see if any dust is present D. answers B and C

5. From the hardness scale chart on the top of page 213, state the hardness of:

   A. your fingernail _____
   B. a copper penny _____
   C. a steel knife blade _____
   D. glass _____
   E. quartz _____
   F. topaz _____
   G. diamond _____

The teacher will demonstrate the use of these materials.

Answers: 1-c, 2-a, 3-a, 4-d
5: A-2 to 3, B-3+, C-5 to 6, D-6, E-7, F-8, G-10

Assessment Task

The availability of materials will determine the size of student groups. No talking will be permitted. Give each student or group of students the following materials: quartz, feldspar, talc, calcite and topaz, a copper penny, a glass plate and a piece of steel or a knife. Identify the quartz. The minerals can be identified by an attached number or letter. Ask the students to order the minerals from softest to hardest according to the hardness scale of minerals.

Objective Four

Given the formula:

$$\text{Specific Gravity} = \frac{\text{Weight of sample in Air}}{(\text{Weight of Sample in Air}) - (\text{Weight of Sample in } H_2O}$$

and a 600 ml. container of water, a length of light thread to suspend the sample in water from the bottom of the balance, a triple beam balance and three different mineral samples of unequal size, the eight grade student will be able to calculate the specific gravity (Weight of the sample relative to the weight of the volume of water it displaces) of each mineral. The student will then be able to order the samples from lowest to highest specific gravity.

Instructional Method - Combination of Teacher Demonstration and Student Discovery.

A. The teacher will demonstrate the method of suspending the sample from the balance in the container of water, and he will illustrate the use of the specific gravity formula through discussing sample problems with the class. Background material relative to Archimedes Principle and buoyancy can be found in the text Energy, Its Forms and Its Changes by Brandwein, et. al.

B. The students will be arranged in groups of three or four. Each group will determine the specific gravity of a sample of iron, aluminum, a wax block and a piece of lead metal. After the activity, the teacher will compare their results (through discussion) with reliable data on the specific gravities of these materials.

Assessment Task

Using the formula for specific gravity, a triple-beam balance, a length of light thread, a 600 ml. container of water and three mineral samples of unequal size which have been identified by a number or a letter, the student will order the samples from lowest to highest specific gravity.

If only a few students can be accommodated at one time, have those who feel the need for further review or study read page 215 in Exploring Earth Science by Thurber and Kilburn or pages 12 to 14 in Earth Science by Namowitz.

Acceptable responses to most rock forming minerals can be found in the index of Earth Science by Namowitz or in the mineral guide accompanying this paper.

Objective Five

Given a list of minerals and their characteristics, and all materials necessary for testing minerals for the characteristics learned in objectives one through four previously, the seventh grade student will be able to name six out of ten minerals that he is asked to test.

Instructional Method Laboratory, Discovery.

The purpose of this activity will be that of having students practice all the mineral tests previously learned. They should also begin to become familiar with some specific minerals and their names.

The students will work in groups of three or four. Each group will be provided with all of the appropriate testing materials needed and at least ten minerals of assorted size, kind, specific gravity, color, luster, streak and hardness. Each student will also be provided with a list of common minerals and their general characteristics and physical properties. These lists should be kept by the student as part of his notebook.

The students will gather data about each of the minerals provided. From this data, they will name the minerals by comparing the data with mineral characteristics given in the chart (guide) on mineral identification.

At the end of the session (which might take more than one class period), the teacher will discuss the minerals and their names. Appropriate background information can be given to the class by having them read the chapters on minerals in Exploring Earth Science by Thurber and Kilburn and Earth Science by Namowitz.

Assessment Task

There will be ten or more stations set up around the classroom. At each station there will be a mineral sample of a type not previously used by the class, and appropriate testing materials needed for the identification of that particular sample. The students will rotate, in turn during a time interval to be decided upon by the teacher, through each station. The students will have with them the attached list of mineral characteristics. They must be able to name six out of ten minerals.

DISTINCTIVE PROPERTIES OF SOME COMMON MINERALS

1. Quartz SiO_2
   A. vitreous (glassy) luster
   B. transparent or translucent
      6 - sided crystal
   C. colorless, milky, smoky, rose
   D. very hard - 7
   E. conchoidal fracture, no cleavage

2. Galena - lead ore - PbS
   A. bright, metallic luster, gray
   B. black streak
   C. excellent cubic cleavage
   D. soft - 2.5
   E. heavy - spg. 7.5

3. Talc $HMgSiO_n$
   A. pearly luster
   B. white - green color
   C. white streak
   D. uneven fracture
   E. flat cleavage
   F. greasy feel
   G. very soft - 1
   H. light weight spg. 2.7

4. Graphite C
   A. metallic to dull luster
   B. black or gray color
   C. black streak
   D. greasy feel
   E. very soft - 1
   F. light weight spg. 1

5. Kaolinite $HALSiO_n$
   A. dull luster
   B. white, gray or colors
   C. white streak
   D. strong, earthy odor, clay
   E. soft - 2
   F. light weight spg. 2.6

6. Biotite (mica) $HKFeMgAlSiO_n$
   A. pearly to metallic luster
   B. black or brown in color
   C. greenish streak
   D. perfect cleavage (transparent sheets)
   E. hardness 2.5
   F. spg. 2.8

7. Muscovite (mica) $HKAlSiO_n$
   A. pearly luster
   B. no color
   C. white streak
   D. perfect cleavage (transparent sheets)
   E. hardness 2.5
   F. spg. 2.5

8. Halite NaCl
   A. vitreous luster
   B. colorless to gray
   C. perfect cubic crystal
   D. white streak
   E. salty taste
   F. hardness 2.5
   G. spg. 2.5

9. Calcite $CaCO_3$
   A. vitreous luster
   B. colorless, tinted
   C. white streak
   D. perfect rhomboid shaped crystal
   E. even cleavage
   F. hardness 3
   G. spg. 2.7

10. Chalcopyrite $CuFeS_2$
   A. metallic luster
   B. brass-yellow in color
   C. greenish-black streak
   D. massive
   E. hardness 3.5
   F. spg. 4.2

11. Hematite Fe_2O_3
   A. metallic to dull luster
   B. reddish-brown color
   C. black or red streak
   D. uneven cleavage
   E. hardness - 6 or less
   F. spg. 5

12. Magnotite Fe_3O_4 (lodestone)
   A. metallic luster
   B. black in color
   C. black streak
   D. hardness 6
   E. spg. 5
   F. strongly magnetic

13. Pyrite FeS_2
    A. mettalic luster
    B. brass-yellow in color
    C. greenish-black streak
    D. cubic crystals outcrop
    E. hardness 6.5
    F. spg. 5

14. Garnet - complex silicate
    A. vitreous luster
    B. white streak
    C. reddish in color
    D. conchoidal fracture
    E. hardness 7.5
    F. spg. 3.8

ART

Behavioral Hierarchy for Line Drawing of Forms Work Copy

The subordinate objectives and the sequence in which they occur are value judgments subject to modification in meeting the needs of the students in a particular learning setting.

The number of instructional strategies and assessment tasks will change with each learning setting.

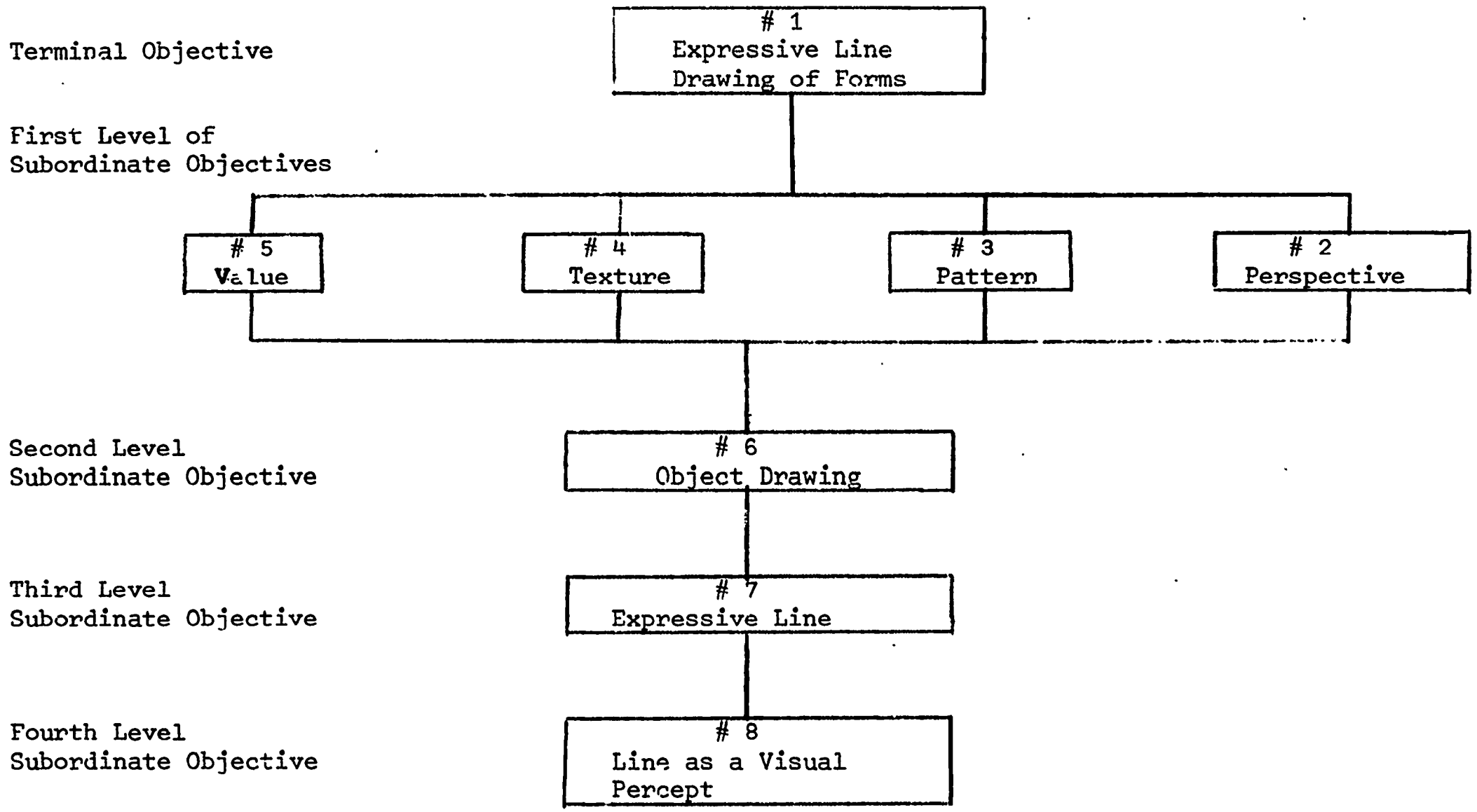
Each subordinate objective cell, e.g.,

etc.

can be considered a unit of instruction.

The resource column is a suggested addition to the format to aid the teacher in preparing her own instructional strategies.

BEHAVIORAL HIERARCHY FOR LINE DRAWING OF FORMS



TERMINAL OBJECTIVE # 1

Expressive Line Drawing of Forms

The 6th grade student will be able to construct a variety of linear drawings of natural and man-made forms selected from the environment in a variety of media, such as pencil, ball point pen, crayon, charcoal, pen-ink, and brush on a variety of surfaces. He will be able to demonstrate the expressive quality of line as determined by the media and the visual effects of light and dark, texture, pattern and simple linear perspective.

Assessment Tasks	Instructional Strategies	Resources
(a) The 6th grade student will choose a man-made form from a variety of forms presented by the teacher. The student will construct a series of five drawings to demonstrate the expressive linear characteristics in each of the following media: (1) pencil and 12" x 18" white drawing paper (2) ball point pen and 9" x 12" white drawing paper (3) crayon and 18" x 24" bogus paper, and; (4) charcoal and 18" x 24" colored pastel paper, and; (5) pen, ink and brush, and 18" x 24" white drawing paper		

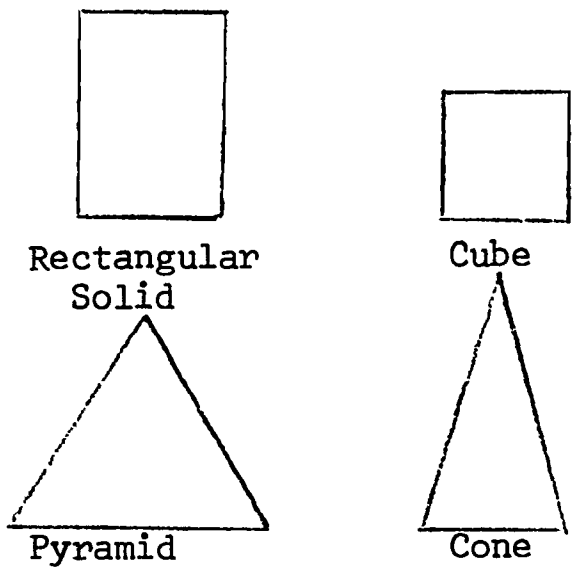
TERMINAL OBJECTIVE # 1 (continued)

Assessment Tasks	Instructional Strategies	Resources
The drawings will illustrate the effects of light and dark and emphasize in at least three separate drawings each of the following linear qualities: (1) texture (2) pattern, and; (3) simple linear perspective (b) The 6th grade student will be taken on a field trip to observe natural forms in the environment. He may choose from a variety of media such as pencil, ball point pen, crayon, charcoal, pen-ink and brush, and a variety of drawing surfaces, the materials needed to construct on the site at least three drawings of separate natural forms that demonstrate the effects of light and dark and emphasize separately each of the following linear qualities: (1) texture (2) pattern, and; (3) simple linear perspective		

SUBORDINATE OBJECTIVE # 2

Perspective

Apply the rules of one and two point perspective on the level that he feels is necessary to express his graphic ideas.

Assessment Tasks	Instructional Strategies	Resources
(a) The 6th grade student will apply the rules of one point perspective in constructing a pencil drawing representing a hallway of the school on 12" x 18" white drawing paper. (b) The 6th grade student will apply the rules of two point perspective in transforming the following two-dimensional shapes into named three-dimensional forms using a pencil, ruler, on spearate 9" x 12" white drawing paper.  	(a) The class will discuss perspective as an optical illusion. One and two point perspective will be related to forms in the actual environment from slides, and student's collections of photographs. (b) The students will practice drawing a simple retangular solid in one and two point perspective using a pencil, ruler, and 9" x 12" white drawing paper.	

SUBORDINATE OBJECTIVE # 3

Pattern

Demonstrate the use of line to create pattern

Assessment Tasks	Instructional Strategies	Resources
(a) The 6th grade student will be able to select three examples of pattern as it occurs in natural forms and construct three recognizable drawings in three 3" x 3" squares of that portion of the surface or structure of the forms that demonstrate the visual concept of pattern. (b) The 6th grade student will be able to construct four original linear patterns with pen and ink in 6" x 6" squares on four separate sheets of white drawing paper to demonstrate the concept of pattern emphasizing each of the following lines separately: (1) vertical (2) horizontal (3) diagonal, and; (4) curved	(a) Show the students examples of pattern in nature using slides. Discuss the concept of pattern, illustrate with visuals of pattern as it occurs, in man-made forms. Have students collect photo examples of pattern in man-made and natural forms for a class display. (b) Give the students 3" x 3" squares of white drawing paper. Have them create a variety of original linear patterns in pencil using both a ruler and freehand. Select six of the drawings which have the strongest characteristics of linear pattern and render in ink.	

SUBORDINATE OBJECTIVE # 4

Texture

Demonstrate the use of line to create texture.

Assessment Tasks	Instructional Strategies	Resources
(a) The 6th grade student, when given five 2" x 3" squares on a 12" x 18" piece of white drawing paper, will be able to render five different textural effects using only a linear technique in pen and ink. (b) The 6th grade student, when given an outline drawing of a shoe, will render it in at least three contrasting textures in pen and ink.	(a) The teacher will define texture presenting a variety of objects, both natural and man-made. The teacher will lead the class in a discussion identifying similar and contrasting textures in the objects observed and touched. The students will be asked to give verbal descriptions of the textures observed and touched. The students will be asked to give verbal descriptions of the textures observed and touched. (b) The student will select a variety of natural and man-made forms with strong textural qualities and practice a variety of linear technqiues to imitate texture in separate 3" squares on 12" x 18" white drawing paper with pen and ink.	

SUBORDINATE OBJECTIVE # 5

Value

Demonstrate the effects of light and dark on natural and man-made objects in the environmental through line drawing techniques.

Assessment Tasks	Instructional Strategies	Resources
(a) The 6th grade student will be able to construct separate value renderings in charcoal on 12" x 18" white drawing paper of simple solid geometric forms. The geometric forms will be placed individually in a shadow box under artificial lighting. Tonal gradations and effects will be rendered as seen in the object. (b) The 6th grade student will be able to construct a value rendering emphasizing linear techniques (no rubbing) of a simple vase, a cigar box, and a paper shopping bag using three of the following marking media: pencil, ball point pen, crayon, charcoal, and pen-ink and brush, on colored or white 12" x 18" drawing paper.	(a) Have a student construct a series of 3" x 5" rectangles on white drawing paper. Demonstrate the techniques of achieving, gradated values in pencil, ball point pen, crayon, charcoal and pen-ink and brush. Allow the students to practice gradated linear effects with a variety of media in the 3" x 5" rectangles. (b) Place a variety of objects, natural and man-made, in a shadow box with artificial conventional lighting. Explain and demonstrate the visual effects created by light and dark on the surface of objects. Allow the students to practice linear renderings for value (light and dark) effects with a variety of media on a variety of surfaces.	

SUBORDINATE OBJECTIVE #6

Object Drawing

Demonstrate the use of basic line drawing techniques to represent recognizable objects.

Assessment Tasks	Instructional Strategies	Resources
(a) The 6th grade student will demonstrate the ability to use contour-outline continuous line, gesture line, and broken line techniques, in constructing five drawings of five different objects in pencil, ball point pen on 12" x 18" sheets of white drawing paper. The five finished drawings must be recognized as being of the objects by 9 out of 10 classmates asked to match the drawing with the object He will be able to apply the rule for blocking-in-lines and checking proportions. (b) The 6th grade student will be able to construct a line drawing of a familiar object with a marking media of his own choice when given a written description of the object. He will construct the drawing on 18" x 24" white drawing paper.	(a) The teacher will arrange a group of natural and man-made objects on a table in the center of the room. The teacher will demonstrate simple procedures for applying the rule for blocking-in-lines and checking proportions. The teacher will demonstrate a variety of line techniques, such as contour outline, gesture line, a continuous line, and broken line. The student will practice line drawings of each of the objects on the table in each of the techniques demonstrated.	

SUBORDINATE OBJECTIVE # 7

Expressive Line

Demonstrate the characteristics of a variety of drawing media and their effect on the expressive qualities of line.

Assessment Tasks	Instructional Strategies	Resources
(a) The 6th grade student will be able to construct, on separate sheets of 12" x 18" white drawing paper, a series of line techniques with pencil, ball point pen, crayon, charcoal, and pen-brush and ink that illustrate for each the following expressive qualities: thin lines — excited thick lines — speed broken lines — calm thin-thick lines — dizzy continuous line — anger gesture lines — happy accented lines — sad (b) The 6th grade student will demonstrate the expressive characteristics peculiar to pencil, ball point pen, crayon, charcoal, and pen-brush and ink in constructing separate line drawings of (1) a glass bottle, and; (2) an old tennis shoe.	(a) Show the students a variety of linear effects achieved through various combinations of surfaces and marking media (pencil, ball point pen, crayon, charcoal, and pen-brush and ink). Demonstrate the characteristics of various media with a series of follow-along exercises. Allow additional time for students to explore the technical possibilities of each media by encouraging non-objective graphic expression. Have students continue exploration of linear visual effects that express mood and feeling. (b) Allow the students to choose one object from a selection of objects displayed in the room and practice line renderings in a variety of media of the same object.	

SUBORDINATE OBJECTIVE # 8

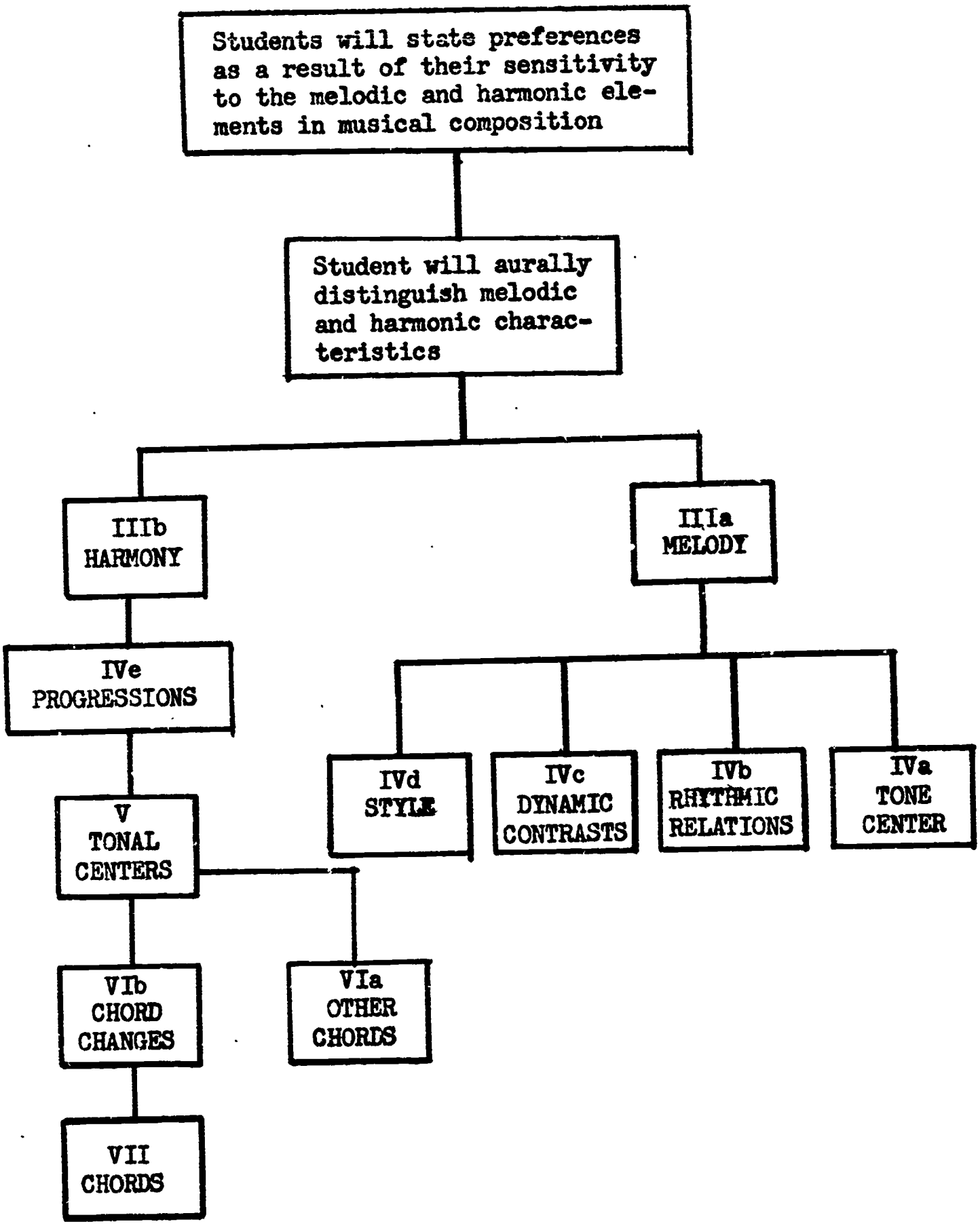
Line as a Visual Percept

Identify line as a visual percept and an expressive element in the environment.

Assessment Tasks	Instructional Strategies	Resources
(a) The 6th grade student, when presented with six photographs of different architectural constructions, will be able to identify the five out of six photographs that convey a dominant vertical line quality. Sky Scraper Poplar Tree Picket Fence Cornfield Groups of Standing People A Sea and Beach Scene (b) The 6th grade student, when presented with twenty-five photographs that include landscapes, seascapes, buildings, animals, and natural and man-made objects, will identify the dominant linear quality correctly in the twenty-five photographs.	(a) Discuss with the students a number of definitions of the meaning of line as a visual percept and how the artist sees line in objects around him. (b) The teacher will give a slide presentation and actively engage the students in a session on identifying the visual percept of line as it occurs in the slides and in parallel examples in the environment. The lines will be identified and categorized for simple expressive qualities, such as, vertical-dignity, horizontal-calm, wavy-soothing, broken-agitated, oblique-unstable, straight-speed, spiral-confusing, scribble-disordered, angular-excited, etc.	

Music

INSTRUCTIONAL SEQUENCE IN MUSIC, GRADE 7



I. Terminal Objective: The student will state preferences as a result of his sensitivity to the melodic and harmonic elements in a musical composition.

Assessment Task: The student, after listening to several musical compositions, is asked to state a preference based upon the melodic and harmonic elements of the composition.

II. Melody and Harmony

Objective: The student can aurally identify melodic and harmonic elements.

Assessment: The teacher will ask the student to listen to a portion of a composition and identify and extract melodic and harmonic components.

IIIa. Melody

Objective: The student will be able to aurally identify the components of a melody.

Assessment: The teacher will play a melody for the student. The student will verbally analyze and describe the melodic structure.

IIIb. Harmony

Objective: Children will be able to aurally identify simple harmonic organization.

Assessment: The teacher will play an accompanied melody for the student. The student will verbally analyze and describe the harmonic structure.

IVa. Tone Center

Objective: The student will be able to aurally identify the resolution or non-resolution of a melodic line of major and minor mode.

Assessment: The teacher will play a one-line melody before which a strong feeling for the key center will have been established. The melody will end upon the 7th degree of the scale. The student will demonstrate by raising his hand that he feels that the melody has resolved.

IVb. Rhythmic Relations

Objective: The student can aurally identify rhythmic variations of a melodic line.

Assessment: The teacher will play a melody line with two rhythmic changes. The student will be able to identify the examples as like or unlike.

IVc. Dynamic Contrast

Objective: The student will be able to aurally identify dynamic changes in a melodic line.

Assessment: The student will be asked to select the melodic line that has been altered by accents from a group of unaltered melodies.

IVd. Style (Expressive Effects)

Objective: The student will be able to aurally distinguish between the various expressive styles within the melodic line.

Assessment: The teacher will play music examples with a variety of styles (legato, marcato, staccato). The student will be asked to name the stylistic changes by labeling smooth, detached or short.

IVe. Progressive

Objective: Children will identify aurally the chordal progression of I, IV, V, I.

Assessment Task #1: The teacher will play a I, IV, V, I progression several times on the autoharp. Children will aurally identify each chord by naming the chord as it is played.

Assessment Task #2: The teacher will play a I, IV, V, I progression on the autoharp. The children will hold up individual cards with a I, IV, or V symbol as they aurally identify the chord played.

V. Tonal Center

Objective: Children can select the tonal center from the I and V chord.

Assessment Task #1: Given a familiar melody requiring the I and V chords as an accompaniment, children will raise their hands upon hearing the I chord.

Assessment Task #2: Given the following chord sequence, I-IV-II-V-I, children will raise their hands upon hearing where a return to the tonal center seems imperative.

VIb. Chord Changes

Objective: Children will aurally identify the need of a chord change as heard in a composition using I and V chords.

Assessment Task #1: Given the same familiar melody requiring the I and V chords for accompaniment, the children will name the I or V chord as played.

Assessment Task #2: Given an unfamiliar melody requiring the I and V chord for accompaniment, children will identify aurally by raising their hands the need for a chord change.

VII. Chords

Objective: Children will aurally identify the difference between a single tone and a chord.

Assessment Task #1: The teacher will sing a familiar melody. She will accompany the melody by playing two different chords on the autoharp. The children will identify hearing the chords by raising their hands.

Assessment Task #2: The children and teacher will sing a familiar melody. The children will raise their hands each time a chord is played.